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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/658,541	09/08/2003	Jeffrey T. LaBelle	9138-0092US	3256

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EXAMINER

KOSSON, ROSANNE

ART UNIT PAPER NUMBER

1651

DATE MAILED: 09/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/658,541

Applicant(s)

LABELLE ET AL.

Examiner

Rosanne Kosson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on August 2, 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-43 is/are pending in the application.
- 4a) Of the above claim(s) 35-43 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 9/9/03 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a). Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 3/12/04
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

Applicants' election without traverse of Group I, claims 1-34, in the reply filed on August 2, 2004 is acknowledged.

Claims 35-43 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to nonelected inventions, there being no allowable generic or linking claim.

Claim Objections

Claims 3, 4 and 23 are objected to because of the following informalities, which appear to be typographical errors. Claim 3 recites "a emission in the direction of ..." (rather than "an emission in the direction of ...," claim 4 recites "a silicon photovoltaic cell," and claim 23 recites "either claimM15 or 16." Appropriate correction is requested.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-34 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement because they are based on a disclosure which is not enabling. The preparation of RC⁻ chlorosomes is critical or essential to the

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practice of the invention, but it is not included in the claim(s) and it is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976).

Specifically, the claimed invention is not enabled because, while the specification teaches a method of preparing chlorosomes, i.e., RC⁺ chlorosomes, from *C. aurantiacus* (see pp. 17 and 18), it does not teach how to separate the B808/866 supramolecular complex and reaction center proteins from the bacteriochlorophyll (Bchl) c and baseplate proteins (see definition of chlorosome on p. 13, lines 7-15) so that intact and functional RC⁻ chlorosomes may be prepared. The specification teaches that the claimed hybrid photoactive device is made with RC⁻ chlorosomes and that a preparation of RC⁺ chlorosomes may be used as a control to test the functioning of the claimed device (see p. 21, lines 5-18, and p. 16, lines 4-6). Thus, the specification does not teach how to make the device that Applicants disclose as their invention.

Accordingly, in order to practice the scope of the claimed subject matter, the artisan of ordinary skill would have expected to have undertaken essentially a trial and error process. Such a process clearly amounts to undue experimentation. Because the specification provides no guidance for preparing RC⁻ chlorosomes, the skilled artisan clearly would have expected to have to experiment unduly to practice the claimed invention. In sum, undue experimentation would be required to practice the invention as claimed due to the quantity of experimentation necessary; limited amount of guidance and limited number of working examples in the specification; nature of the invention; state of the prior art; relative skill level of those in the art; predictability or unpredictability

in the art; and breadth the claims (In re: Wands, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988)). A holding of non-enablement is, therefore, clearly required.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. There is no clear definition in the claims or in the specification as to what elements are required for any particular structure to be considered a "chlorosome." Because it is not clear what elements or combination of elements are required to constitute a chlorosome, the metes and bounds of the term "chlorosome" are not clear. For example, the specification at page 13 refers to both RC^+ and RC^- structures as "chlorosomes." Each of these structures, however, contains different elements. Because of the inconsistent terminology in the specification, it is simply not clear what elements are required for any particular structure to be termed a "chlorosome." Thus, a holding of indefiniteness is required.

Claims 1-6, 8-18 and 20-34 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are that the recited "chlorosomes" are RC^- chlorosomes, as discussed above, because the specification defines chlorosomes as RC^+ chlorosomes (see definition of chlorosome on

p. 13, lines 7-15). As the specification teaches that Applicants' hybrid photoactive device is made with RC⁻ chlorosomes (see p. 21, lines 5-18, and p. 16, lines 4-6), the invention as claimed must also recite that it comprises RC⁻ chlorosomes. Thus, a holding of indefiniteness is required.

Claims 1-14, 17, 21 and 22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Claim 1 recites "a plurality of chlorosomes supported in light communicating relation to a surface" The phrase "in light communication relation to" is not defined in the specification. It is unclear from the specification and the drawings how the chlorosomes, e.g., in the glass encased chlorosome array shown in Figure 11, are connected to the photovoltaic cell so that photocurrent is transmitted to the photovoltaic cell. Additionally, claims 2 and 17 recite that "a substantial number" of chlorosomes are oriented with their base plates facing the photoactive semiconductor. The term "a substantial number" is not defined in the specification. Thus, Applicants' intended meaning of the claims is unclear, as it cannot be determined what is included or excluded by the claim language.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-26, 33 and 34 are rejected under 35 U.S.C. 102(a) as being anticipated by LaBelle (Design feasibility of a nanoscale biophotonic hybrid device, Ph.D. Dissertation, Arizona State University, Dec. 2001), Pizziconi et al. (Preview before Submission, NSF Project Report, Version 1.2, printed from the Internet on Sep. 6, 2002), LaBelle et al. ("Nanoengineered interface for biophotonic hybrid device components," MCTB Lab, Dept. of Bioengineering, Arizona State University, undated publication), or LaBelle et al. ("Nanoscale biophotonic hybrid biosensor," MCTB Lab, Dept. of Bioengineering, Arizona State University, undated publication). Each of these publications discloses a hybrid photoactive device for the conversion of light to electric current in which one or more layers of oriented Bchl c molecules from *C. aurantiacus* are bound to a glass support and coupled to a silicon-containing semiconductor photovoltaic cell. These publications antedate Applicants' priority date of September 7, 2002 or are undated, and the authors are a different inventive entity than the inventors in the instant application. Because these disclosures teach Applicants' claimed invention, a holding of anticipation is required.

Claims 1-3, 8-11, 15, 17, 20-24 and 26 also are rejected under 35 U.S.C. 102(b) as being anticipated by Miyasaka et al. (Science 255(5042):342-344, 1992). Miyasaka discloses a hybrid photoactive device for converting light irradiation to electric current,

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and a method of making this device, in which fragments of chlorosome-containing bacterial membranes are applied as a series of monolayer films onto a transparent tin oxide semiconductor layer. The chlorosome-containing film and semiconductor layer are then sandwiched in glass and connected to a photocurrent output, so that light is efficiently absorbed and transmitted. A substantial number of chlorosomes are oriented with their baseplates facing the semiconductor layer, and the chlorosome-containing membranes adhere to the transparent semiconductor layer. The chlorosomes have a diminished response at certain wavelength ranges and an enhanced response at other wavelength ranges- they absorb green light and emit radiation in the infra-red range (see p. 342, last paragraph, and p. 343, as well as Terpugov et al., Biochemistry (Moscow) 66(11):1315-1322, 2001, Figure 2 on p. 1317 regarding radiation emission from Halobacteria). Because Miyasaka teaches the subject matter recited in claims 1-3, 8-11, 15, 17, 20-24 and 26, a holding of anticipation is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-26, 33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over He et al. (Advanced Materials 11(6):435-446, 1999) in view of Miyasaka et al. (Science 255(5042):342-344, 1992) and Planner et al. (Journal of Photochemistry and Photobiology A: Chemistry 115:151-155, 1998). He discloses a hybrid photoactive device for the conversion of light to electric current comprising a film containing bacteriorhodopsin (bR) in which the protein units are oriented in a specific manner so that light is efficiently absorbed and transmitted (see p. 435, 2d and 3d paragraphs; pp. 437-439, paragraphs entitled Potential Applications of bR and LB Technique; and Figure 1). He also discusses the hybrid photoactive devices of Miyasaka. Miyasaka discloses that monolayers of bR are layered in a controlled fashion on a semiconductor layer of SnO₂, which is sandwiched in glass and connected to a photocurrent output, and that the device is activated by irradiation with green light (see p. 343). He does not disclose using bacteriochlorophyll c (Bchl c) from *C. auranticus* or coupling the Bchl c protein directly to glass. Planner discloses devices in which Bchl c protein is coupled directly to silica glass, which stabilizes the protein molecules. When irradiated (with combination nitrogen-dye lasers), the Bchl c emits light with peak intensities of 434 and 666 nm (see p. 151, Introduction, and p. 152,

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Results and Discussion). This emission spectrum is similar to that of Applicants' Bchl c, which, following irradiation, emits light with peak intensities of 440, 456, 670 and 740 nm. Thus, one of ordinary skill in the art would have been motivated to modify the hybrid photoactive device of He and Miyasaka by using Bchl c bound to glass, as disclosed by Planner, and coupled to a photocurrent output, because Planner discloses the light energy transmission properties of Bchl c and its stability when contained in silica glass. The artisan of ordinary skill would also have recognized that Miyasaka discloses that light emitted by a layer of a bacterial energy-transmitting pigment may be used to drive photoactive devices and that a bacterial pigment layer, such as a layer of Bchl c, would have been coupled to a photoactive device. Therefore, a holding of obviousness is required.

The prior art does not anticipate or reasonably suggest force adapting chlorosome-containing bacteria with a light response at a particular range of wavelengths or using chlorosomes from such bacteria in a hybrid photoactive device. The prior art also does not anticipate or reasonably suggest calculating a figure of merit to evaluate the force adaptation of the bacterial chlorosomes.

No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rosanne Kosson whose telephone number is 571-272-

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2923. The examiner can normally be reached on Monday-Friday, 8:30-6:00, with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Wityshyn can be reached on 571-272-0926. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rosanne Kosson
Examiner
Art Unit 1651

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2004-09-03

A handwritten signature in black ink, appearing to read 'Francisco Prats', with a stylized, cursive script.

FRANCISCO PRATS
PRIMARY EXAMINER